

SOTA Beams

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SITE FOR ALL SORTS
OF USEFUL ITEMS TO
ENHANCE YOUR
PORTABLE RADIO
OPERATING!**

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SOTA Beams



**SB5 LIGHTWEIGHT HIGH-
PERFORMANCE
PORTABLE
YAGI SYSTEM**

Introduction

Thank you for purchasing the SB5 Portable Yagi System. This beam has been designed with lightweight portable radio operating in mind. Every component and aspect of its design has been carefully considered to make it as easy as possible to assemble, carry, and use. It has been designed by Richard Newstead, G3CWI, who has over 25 years of portable radio operating experience in places as wild as Antarctica! The art of effective portable operating relies on



TIP—Throughout these instructions you will see boxes with tips and notes. Tips are things that you may wish to do to enhance the performance of your system.

good preparation so read these instructions carefully and practice with your new antenna at home before you take it into the wilds.

Preparing the system for use

Before using your SB5 there are a few simple tasks to undertake:

- 1) Assembly of the antenna elements
- 2) Assembly and adjustment of the guying system
- 3) Construction of the feeder system
- 4) Learning how to erect the system.

You may have many years of experience or perhaps you are new to radio but either way, we suggest that you read and follow these instructions before trying to use our SB5.

Tools

You will need the following simple tools:

- Tape measure (a metal measuring tape is best)
- Ruler
- Craft knife
- Soldering iron and solder

Operating tips

“Location, location, location” is the cry of estate agents but it is equally applicable to radio amateurs. Getting the best out of your beam demands choice of the right location. Height makes a big difference on 2 metres so aim to get to a local high point.

Most antennas work best if the ground falls away in the direction you want to make contacts in. Operating from the middle of a high plateau is therefore often discouraging while operating nearer the edge will improve things a lot.

Mount the antenna horizontal for SSB (elements parallel to the ground) and vertical for FM. FM sounds nicer but far greater range will be achieved with SSB!

Be considerate when operating portable. Don’t put guys across paths and generally avoid getting in people’s way. Don’t make lots of noise on the hills either—people often come to hilltops to enjoy some peace and quiet so please don’t give them a bad impression of our hobby.

Guarantee

These beams have been designed for portable operation. They are not suitable for permanent home-station use. We guarantee these beams to be free from manufacturing defect for 12 months from the date of purchase. If you have any problems or questions about the beam, please contact us by e-mail (Richard@sotabeams.co.uk) or by post to: SOTA Beams, 89 Victoria Road, Macclesfield, Cheshire, SK10 3JA. You can also contact us by phone on 01625-425700 during normal working hours.

The [SOTA](#) name and logo are used with express permission of the SOTA management team. The SOTA programme is a not-for-profit Amateur Radio organisation which is wholly independent of SOTA Beams and ECS Ltd.

Help!

Additional photographs of the construction techniques and the beam in use are at <http://www.sotabeams.co.uk/sb5-help.htm> This page will also show any updated construction information.

A SOTAbears user group is at:

<http://groups.yahoo.com/group/sotabeams/>

Still stuck?

If you have any problems or questions about the beam, please contact us by e-mail (Richard@sotabeams.co.uk) or by post to: SOTA Beams, 89 Victoria Road, Macclesfield, Cheshire, SK10 3JA. You can also contact us by phone on +44 (0)1625-425700 during normal UK working hours.

Warnings

Never use your antenna on a hilltop when there are thunderstorms nearby or forecast.

Always ensure that your antenna is erected in such a way that it does not represent a hazard to yourself or others.

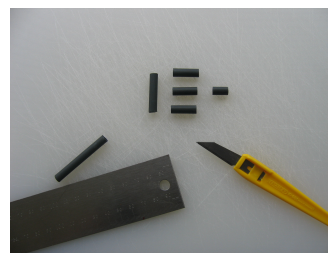
Never erect an antenna near to power lines.

- Safety goggles
- Wire cutters
- Hot air gun (paint stripper gun)
- Pencil

1) Assembly of the Antenna Elements¹

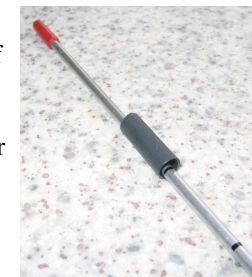
Remove the soft plastic cap from the longer of the plastic tubes and tip out the antenna elements. Cup them in your hand to stop them falling on the ground! There are six rods which have been precision cut to work first time. Find the packet of red soft plastic endcaps. Put an endcap on one end of each of the rods so that all the rods have one endcap on. The two shortest rods (each about 48cm long) form the driven element of the Yagi and are now complete; put them to one side. You now have four long elements left.

 **TIP**—The caps slide on easier if you moisten the ends of the rods with saliva (yuk!).



Find the length of 4mm heat-shrink sleeving and, using a craft knife, cut a piece 1cm long. Make sure that you cut squarely across the tubing. Next cut three pieces 2cm long and one 3cm long. Keep the remaining sleeving—it will be used later.

Select the longest element (just over 1m long). From the end without the endcap, measure 527mm and mark the rod with a pencil. Make a second mark 552mm from the same end (you should now have two marks 25mm apart). Slide a 2cm piece of heat-shrink sleeving down the element so that the end of the sleeving is at the mark nearest the endcap (see photograph). Note that the photo shows the marks much closer to the endcap than they will be on your element. Using the hot air gun, heat the sleeving so



that it shrinks onto the element and the epoxy glue coating inside the sleeving melts. Before it cools make sure that the end of the sleeving is exactly at the mark on the element—you can move it a little while it's hot (careful!). Get another 2cm piece of sleeving and do the same process again (see photo below). This completes



the reflector.

Select the shortest element (just under 1m long). From the end without the endcap, measure 474mm and mark the rod with a pencil. Slide a 1cm piece of heatshrink sleeving down the element so that the end of the sleeving is at the mark nearest the endcap as above. Using the hot air gun, heat the sleeving so that it shrinks onto the element and the epoxy glue coating inside the sleeving melts. Before it cools make sure that the end of the sleeving is exactly at the mark on the element—you can move it a little while it's hot (careful!). This completes the front director.

You should now have two element of the same length (just under a metre). Select either one. From the end without the endcap, measure 483mm and mark the rod with a pencil. Slide a 2cm piece of heatshrink sleeving down the element so that the end of the sleeving is at the mark nearest the endcap as above. Using the hot air gun, heat the sleeving so that it shrinks onto the element and the epoxy glue coating inside the sleeving melts. Before it cools make sure that the end of the sleeving is exactly at the mark on the element—you can move it a little while it's hot (careful!). This completes the second director.

You now have just one element left. From the end without the end-



Summits on the Air

SOTA Beams is keen to support the aims and objectives of the Summits on the Air award programme.

Summits on the Air (SOTA) is an award scheme for radio amateurs and shortwave listeners that encourages portable operation in mountainous areas. SOTA has been carefully designed to make participation possible for everyone - this is not just for mountaineers! There are awards for activators (those who ascend to the summits) and chasers (who remain in the warmth of their radio shacks!).

For details of this exciting award see:

www.sota.org.uk

Under 18?

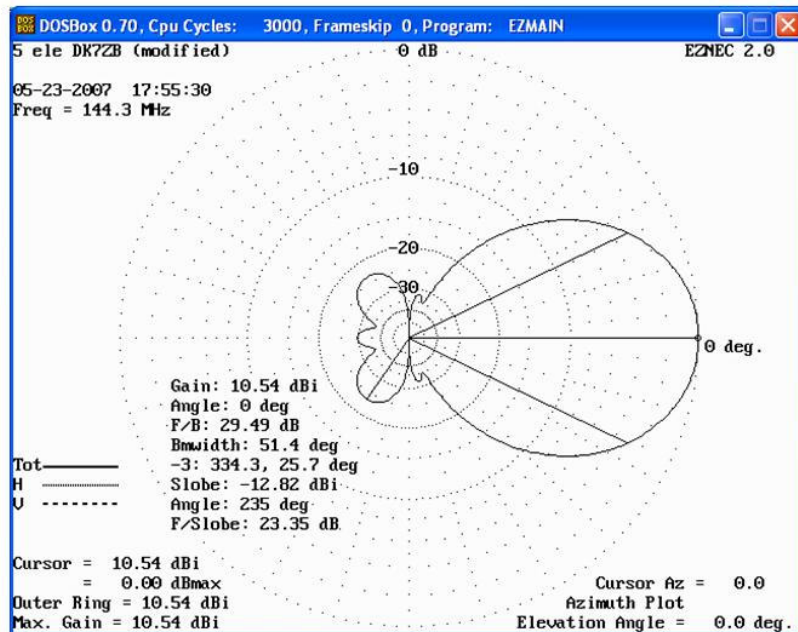
Take part in the SOTA Challenge and win some portable radio gear!

Details at:

<http://www.sotabeams.co.uk/Challenge.htm>

Technical Stuff

The SB5 is based on a design by Martin DK7ZB. It is used with his permission—thanks Martin. The exact dimensions are slightly different due to the different production techniques and materials we have used. The polar diagram is shown below. This is the Free Space diagram.



The VSWR should be below 1.7:1 across the 2m band. A stacking kit with various contest enhancements is available at www.sotabeams.co.uk.

The recommended maximum power rating for the standard version (with crocodile clips) is 25W. The contest kit is rated at 400W.

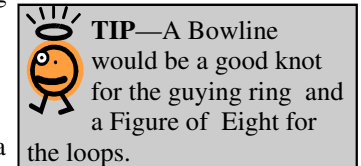
cap, measure 487mm and mark the rod with a pencil. Slide a 3cm piece of heatshrink sleeving down the element so that the end of the sleeving is at the mark nearest the endcap as above. Using the hot air gun, heat the sleeving so that it shrinks onto the element and the epoxy glue coating inside the sleeving melts. Before it cools make sure that the end of the sleeving is exactly at the mark on the element—you can move it a little while it's hot (careful!). This completes the third director.

The elements can now be returned to the boom tube for safe keeping.

2) Assembling the Guying System

You will need a tape-measure, a pair of scissors, a box of matches.

Locate the hank of guying cord and cut into four equal lengths. In the components pack you will find a plastic ring about 35mm in diameter and 25mm long. This is the guying ring. Tie each one of the four length of cord to the guying ring as illustrated. Tie a loop about 5cm long in the other ends of the cords. Seal the ends of the nylon cord with a



lighted match being careful not to set the cord alight or to drop burning nylon on yourself or anything else. Once all four guylines are complete, fold and loosely knot them to keep them tidy.

We have used a 4-guy system for this aerial as it gives greater stability and control when erecting and taking down the system. This is

breeze springs up!

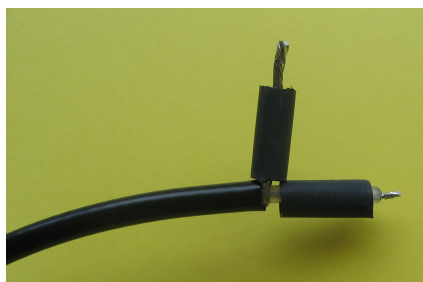
Preparing the feedline

Need: ruler, craft knife, wire strippers, soldering iron, solder, small vice, heat gun.



The SB5 is supplied with feeder cable that is fitted with a BNC plug. Take the unterminated end and feed 80cm up through the choke sleeve as illustrated.

Wind eight turns of cable on the sleeve (tightly) and pass the unterminated end down through the hole in the other end of the choke sleeve. You should now have about 10cm of co-ax protruding from the choke sleeve.



Strip exactly 25mm of the outer insulation and make a pigtail (not a pig's ear) of the braid as shown. Strip 5mm of insulation of the centre core and tin 5mm of the ends of the braid and core. Cut two pieces of heat-shrink sleeving (supplied) 15mm long. Slide these over the centre core and braid as far down and away from the tinned area as possible (see photo).

Put one crocodile clip in a vice and lightly tin the end. Put the braid into the clip, bend over the cable support tabs and solder. Solder quickly to avoid excess heat shrinking the sleeving. Slide



TIP—The SB5 has an exceptionally clean radiation pattern so it's handy to know where it is pointing. Put a piece of insulating tape around the top of the lower mast section and mark it A,B...H at 45 degree intervals. When you have chosen your operating position (on the ground near the aerial), use a compass to make a table of aerial directions e.g. C=East, D=South East, E= South etc. This will help you to point your aerial accurately. Leave the tape on and make a new table each time you use the SB5. Don't forget a compass!

You will have noticed that the heatshrink sleeving is used to identify the elements—if they are inserted in the wrong positions your beam will not work! Once the beam is assembled, lay it flat on the ground out of the way.

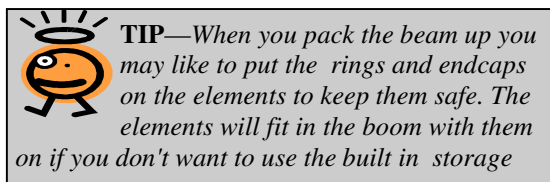
Run the feeder along the length of the mast such that the choke is at the top of the mast. Loosely clip the feeder to the mast with two cable ties about 1m and 1.5m down from the top. Slide the beam onto the mast using centre pair of brackets. Mount in with the elements horizontal for use on SSB and vertical for use on SSB.

Clip the crocodile clips onto the elements as shown in the photograph. Make sure that they get a good “bite”. Tighten the cable clips such that there is no strain on the crocodile clips from the feeder running down the mast. This is **VERY** important!

Once the beam is on the mast and the feeder is attached, lift the mast to vertical and peg. You are now ready to operate.

In very windy conditions you may be reluctant to erect the SB5. In that case, use the **Stubby**. The **Stubby** is a 3 element close spaced Yagi and is made with just the short boom section. As a director use the element with the 1 cm sleeving—this gives the best VSWR. The **Stubby** has its own set of brackets.

Test have shown that the SB5 and **Stubby** have a reasonable VSWR on 70cm. Performance is not guaranteed on this band and the radiation pattern is very odd. However, you might make a few contacts.



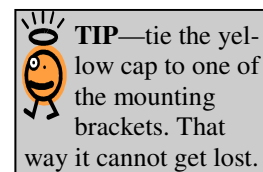
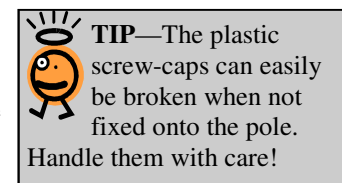
the sleeving over the crocodile clip as far as possible and shrink using a heat gun. Repeat the process with the centre core. To waterproof the open top of the co-ax, use a thin clear glue such as Bostik.

Arranging the Guys for Travelling

Guys can be a problem on hilltops. They can easily get in a tangle unless you handle them with care. We recommend that you double up each guy then loosely tie it with an overhand knot. Finally slide an elastic band over it to keep it together. Do this with each guy so that you have four bundles. It is well worth taking the time to do this properly when you pack up on a hilltop too.

Preparing the Pole for use

For VHF only use, it is often easiest to remove the three thinnest sections of the 7m telescopic pole. Do this by unscrewing the plastic endcap and sliding the three thinnest sections out at the base of the pole. Replace the screw cap.



And finally

In the pack you will note a yellow cap. This fits over the end of the nylon boom connection part and creates a little storage compartment. Put 4 of the plastic element endcaps and four of the small O rings in there. The cap has a long pull-tab allowing you to remove it with gloves on.

Locate the three reusable cable ties (also specially selected to be usable with gloves on!) and store them with the elements inside the long boom section.

You are now ready for your first expedition. However, we advise that your first expedition is to your garden or a local park on a fine day as you can then practice the techniques that will allow you to use your SB5 successfully under all conditions.

TIP—Use the cable ties to attach the long part of the boom to the pole for easy carrying

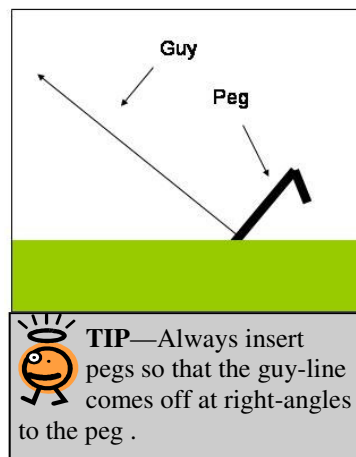
Getting on the Air

On arrival at your operating location choose a flat area of ground about 5m by 5m. Check to see which direction the wind is coming from. Extend the pole. Start by pulling out the smallest section first. Lock each section by pulling firmly at the same time as twisting the section. This makes the sections lock in place using friction.

Lay the pole on the ground with the tip facing into the wind. Slide the guying ring down the mast as far as it will go. Peg out two side guys and a back guy. Erect the pole and peg the final guy. Adjust the guys so that they are all at 90 degrees to each other and are all well pegged and not too tight.

Slip off one guy so that the pole can be lowered into the wind. The next stage is to assemble the beam.

Remove the soft rubber endcap and take the elements and cable ties out of the long boom section. Keep the endcap safe as you will need it when you pack up again. Remove the yellow



TIP—Always insert pegs so that the guy-line comes off at right-angles to the peg.

TIP—The friction lock is quite reliable in most cases but may fail in windy conditions, causing one or more sections to collapse. This is likely to damage the aerial and pole. To avoid this happening, you may like to make a safety lock system. This is done by drilling a small hole through both sides of the pole just above the joint. In use a solid rod can be inserted through the holes which will stop any collapse happening. We recommend a 3mm diameter rod and a 3.1mm diameter hole. The best way to drill the hole is to do one side at a time and then rotate the pole to drill the other side.

cap and put the O rings and small element caps to one side.

Connect the long boom section to the short boom section and slide the element with the 3cm heatshrink marker (D3) through to hold the boom together (you may find that you do not need an O ring to hold this element in place). The two short element sections are the driven element. These must be inserted either side into the holes in the nylon bolt. Locate the element with two heatshrink markers (Reflector) and insert through the boom at the end closest to the driven element. Only push it about 2cm through, then slide an O ring over the end and slide it all the way through so that the O ring remains next to the boom and will stop the element falling out; this is quicker than sliding the O rings on after fully inserting the elements. Insert the remaining elements as shown in the diagram.

